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Virtual Reality Simulation-Based Training: The Way to Go!

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Simulação endoscópica baseada em realidade virtual: o caminho a seguir!

Palavras Chave
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The master-apprentice model in the learning of endoscopy was the standard until recently, posing significant challenges in both patients' experience and trainee interest. Fortunately for all, mechanical, virtual reality (VR), and animal models were developed and are increasingly used for both novice trainees and experts with interest in advanced endoscopic techniques. Advantages of virtual simulation models include a less stressful and risk-free environment, allowing also specific training for predetermined tasks (such as recognition of anatomical structures and pathology, exposure of mucosa) and virtually unlimited number of repetitions [1, 2].

Although virtual simulators have unquestionable advantages, the costs and the demand of trainers are drawbacks of simulation which limits its adoptability, at least if their advantages are not clearly demonstrated. The methods for integration of simulators in the curricula of trainees are also a matter of discussion. In this issue of GE, two original research articles assess the benefit of simulation models in the context of Society of Digestive Endoscopy (SPED) courses.

Silva Mendes et al. [3] conducted a prospective study including 23 participants that attended a theoretical and hands-on module (20 h, including theoretical part, psychomotor exercises, and 8 VR cases [4 endoscopy and 4 colonoscopy]) and assessed pre- and post-cognitive component and technical component. They showed that this training structure allowed to improve cognitive score (from 11 pre-test to 14 post-test) and technical aspects. Indeed, this training improved time to D2/cecum, decreased the time the patient was in pain, and improved the efficiency of screening (composite score using time of procedure and percentage of examined mucosa).

In another study published in this issue, Morato et al. [4] randomized 19 novice endoscopists to a study group (performing three psychomotor exercises) and a control group before training in the VR model (10 colonoscopy

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repetitions in both groups). A final case was used to assess the skills, and those were different between the groups. Indeed, the group exposed to psychomotor exercises before practicing on the simulator had a significantly lower mean cecal intubation time and achieved a higher number of screening efficiency during the 10 colonoscopy repetitions. Although on the final case the groups only significantly differed on the percentage of exposed mucosa, the study group presented an inferior interquartile range in the different metrics evaluated.

Some studies have demonstrated that simulation-based education improves endoscopic process skills in test setting and in clinical practice, as well as in patient outcomes, compared with no intervention [5]. Evidence has been more robust for colonoscopy, where the effectiveness of VR simulators/simulator-based training in accelerating the learning of practical skills, speeding up the early learning curve, thereby reducing patients' burden has been well established [6, 7].

The benefits of such training translate into the first patient procedures, and therefore, its usefulness depends on the employment of these programs prior to patient-based endoscopy. To achieve this purpose, it is important to mention the factors that have limited simulation-based training widespread. These include accessibility, participants' engagement, and operational issues, such as simulation costs, the need for skilled trainers, along with the time and complexity related to its design, preparation, implementation, and evaluation.

The relevance of scientific society involvement, in this case the Education Committee of SPED, to address the aforementioned challenges seems obvious. The merit of Silva Mendes study [3] does not rely on the demonstration of the clinical benefit of VR models, but on reinforcing that creating an organized, evidence-based training program improves cognitive and technical skills and is feasible on a large scale. In this way, its impact is not simply limited to the participants of the study, but it is extended to a set of gastroenterologists in a country or region and consequently the entire potentially target population of endoscopic procedures is covered.

Generally, when designing an instructional simulation-based learning, important steps should be followed, such as establishing the learning goals/objectives, selecting a simulation modality that best supports them, planning adequate feedback/guidance, and considering how learners may be assessed. The program presented in these studies sought to reflect those principles and propose a structured, standardized, and supervised training course. Cognitive skills were addressed, and technical skills improved as documented by better performances at the end of the program.

For a VR simulator to be implemented in a training program, it must also achieve validity and the performance should improve after repetition [7]. The added value of Morato study [4] was to establish the construct validity of two VR exercises (Endobubble I and Navigation I). The psychomotor training provided by these exercises resulted in homogeneous acquisition and assimilation of colonoscopy skills by the trainees. Interestingly, this evidence was used to incorporate them in the training program on which Silva Mendes study relied [3].

On the other hand, the absence of construct validity of exercise *Mucosal Evaluation I* and the inconsistency of the percentage of mucosal surface examined demonstrates that these types of studies are fundamental to investigate and select exercises that should or should not be included in VR simulation. Those ought to reflect clinical competency parameters, but must necessarily be validated and a learning curve must be verified.

Another significant message is the relevance of structuring training. Performance momentarily worsened when feedback was interrupted and in a time-after session, revealing the importance of feedback/debriefing and the temporal distribution of the exercises.

Previous studies have demonstrated the effect of simulator training measured in VR as well as patient-based endoscopy and have also compared simulator plus bedside-training versus bedside-training alone [8, 9]. Both studies on this issue of GE assumed this, and assessments were carried out in the VR models, not in patient-based endoscopy.

The structured training system established might serve as a framework to compare it with different programs, which may include different validated VR exercises. Additionally, this learning program could (and should) be adapted to several other endoscopic techniques.

A wide array of opportunities exists in regard to exploring the use of simulators in conjunction with existing assessment tools for demonstrating competence in endoscopy [10].

Finally, future simulation modalities should consider the best approach to the integration of nontechnical skills and its assessment, since training programs have focused mainly on cognitive and technical skills.

In conclusion, it seems imperative to implement structured endoscopy education programs that incorporate simulation-based training.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Ricardo Küttner-Magalhães and Diogo Libânio designed, wrote, and reviewed the manuscript.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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